

Lead Scientist's Report

Summary: This report includes seven items: (1) Summary of one article from *San Francisco and Estuary Watershed Science* on the habitat potential of flooded polders in the Delta; (2) Summary of one article from *Global Change Biology* on the effects of wet and dry periods on community composition in San Francisco Bay estuary; (3) Independent Review Panel Report for the 2017 Long-term Operations Biological Opinions (LOBO) Biennial Science Review; (4) Summary of a brown bag seminar on water quality monitoring in the Delta; (5) Announcement of the addition of three new members to the Delta Science Program's Science Advisory Committee; (6) Announcement of the upcoming salmon disease workshop; and (7) By the Numbers Report.

Evaluating the Aquatic Habitat Potential of Flooded Polders in the Sacramento-San Joaquin Delta. Durand, John, R. *San Francisco Estuary and Watershed Science*. December 2017.

Past land-use practices in the Sacramento-San Joaquin Delta have led to high rates of subsidence (gradual sinking of land), which in turn has created areas of land that are substantially below sea level. These areas of diked, low-lying land, also known as polders, are especially vulnerable to flooding from earthquakes, levee failures, and sea-level rise. While some flooded polders undergo repair and preservation because of their high economic or resource management value, some are abandoned because either the cost to restore them is too high or they were earmarked for restoration. The potential role that flooded polders could play to support native species, however, is not well understood.

Each polder possesses unique physical characteristics that define the potential future conditions if it floods, as well as the species it will support. Deeply subsided areas are more likely to develop into habitats similar to freshwater lakes and support invasive species; whereas, regions with low levels of subsidence are more likely to become brackish estuaries and support native species. Dr. Durand examined regional and local differences that influence the aquatic habitat found in flooded polders, considering elevation, flow, and turbidity in adjacent channels. He developed a Native Species Benefit Index (NSBI) to evaluate the suitability of 78 polders (all of which have varying potential to flood) in supporting native fish species.

The NSBI was applied to polders throughout the Sacramento-San Joaquin Delta to help managers determine where to direct their restoration efforts to provide the largest amount of functional habitat. Three categories of physical attributes: 1) elevation; 2) flow; and 3) turbidity were scored based on the expected benefits; with higher scores indicating physical attributes of an area that would result in the creation of a desirable habitat. Regions with higher scoring polders were characterized by high flows, high turbidity, and/or shallow depth. Data from existing flooded areas support these

relationships. For example Liberty Island, a major flooded polder that ranked in the top 25 percent of scores, has moderate flows, high turbidity, and variable water depths, and it supports a high proportion of native fish species. Overall, polders that, if flooded, would be more likely to support restoration and conservation goals for native fish had the highest scores across all three physical attribute categories (e.g., polders near the confluence of the Sacramento and San Joaquin Rivers). Polders that are the most likely to flood and become abandoned (e.g., in the south Delta) offer the fewest conservation benefits.

Dry and Wet Periods Drive Rapid Shifts in Community Assembly in an Estuarine Ecosystem. Chang, Andrew; Brown, Christopher; Crooks, Jeffrey; Ruiz, Gregory. *Global Change Biology*, 2017; 1-16 3. October 5, 2017.

One projected impact of climate change is an increased frequency of precipitation extremes, meaning that we can expect more frequent droughts and more frequent winters with heavy rain. Investigating how these changes might impact ecosystems can help inform resource management strategies. In this article, Dr. Chang and his colleagues asked how future weather extremes might affect invertebrate animal communities in the San Francisco Bay estuary by investigating how droughts and wet periods during 2001-2013 affected the types of non-mobile invertebrates present at the Richmond Marina.

During wet winters, higher amounts of freshwater flow through the Delta and into the Bay, and these freshwater flows lead to less saline water conditions in the Bay. Conversely, dry winters lead to decreased flows, and therefore saltier conditions. In this study, researchers observed that winter salinity in the Bay had a major effect on the types of invertebrate species that survived:

- Dry winters (low flows and high salinity) correlated with heavy invasion of non-native sea squirts (*Ciona robusta*). This finding was particularly striking during major droughts.
- Winters with moderate flow, and therefore moderate winter salinity, correlated with the most diverse invertebrate community.
- Extremely wet winters (high flow and low salinity) caused the existing community to suffer near-complete mortality. This allowed for a new community to establish and dominate, with a mix of different sea squirts and bryozoans, also non-native.

This research investigated how an entire community of animals in the Bay-Delta responds to extreme climate conditions. This is important because scientists predict that what is now considered an “extreme” event will be closer to the norm as the climate changes. Management considerations from this study include evaluating how freshwater flows could be used as a mechanism for controlling certain non-native species. Yet, the authors emphasize that while their research shows how some species thrive in dry conditions, the results do not show that in general, either dry or wet conditions promote non-native invertebrate species.

Independent Review Panel Report for the 2017 Long-term Operations Biological Opinions Biennial Science Review

In January 2018, the report of the Independent Review Panel (IRP) for the 2017 LOBO Biennial Science Review was issued. An independent science panel reviewed the implementation of actions required by the Endangered Species Act for salmon, steelhead, green sturgeon, and delta smelt to operate the State and federal water projects. The 2017 LOBO review focused on four major topics: 1) Stanislaus River Watershed/ Eastside Division Reasonable and Prudent Alternative (RPA) actions across Water Years 2011-2017; 2) Evaluation of the Enhanced Delta Smelt Monitoring (EDSM) Program; 3) Old and Middle Rivers (OMR) Index Demonstration Project; and 4) the National Marine Fisheries Services (NMFS) draft proposed Shasta RPA amendment.

The IRP's findings included positive feedback on progress toward the incorporation of more direct links between the biological and physical components of the approaches used to guide water operations, the coordination of agencies involved in the Stanislaus Operations Group, and the statistical design of the EDSM program. The IRP's report also included recommendations for addressing scientific uncertainties, study design improvements, and alternative evaluation methods for the four major review topics.

The 2017 LOBO Biennial Science Review was convened by the Delta Science Program at the request of NMFS, the U.S. Bureau of Reclamation, and U.S. Fish and Wildlife Service (USFWS). The purpose of the review is to inform NMFS and USFWS as to the efficacy of prior years' water operations and regulatory actions prescribed by their respective RPAs. The review enables NMFS and USFWS to develop lessons learned, incorporate new science, and make appropriate, scientifically justified adjustments to the implementation of the RPA actions to inform future water operations. The IRP's findings and recommendations provide objective feedback to agency staff to inform rapid decision-making.

To read the IRP report and access information about the 2017 LOBO review, please visit: <http://deltacouncil.ca.gov/events/2017-long-term-operations-biological-opinions-lobo-biennial-science-review>.

Brown Bag Seminar

Increasing Efficiency and Effectiveness through Collaboration: Considerations from the California Water Quality Monitoring Council – Karen Larsen, Deputy Director, State Water Resources Control Board.

The Delta Independent Science Board (Delta ISB) is undertaking a broad review of the monitoring enterprise in the Delta. To help inform this review, the Delta ISB hosted a three-part seminar series focusing on the current state of monitoring in the Delta. Karen Larsen's brown bag, the third in this three-part series, focused on the California Water Quality Monitoring Council (CWQMC). As a response to concerns surrounding inconsistencies and inefficiencies of water quality data management and accessibility, the CWQMC was created to coordinate water quality monitoring efforts across the state.

The CWQMC provides access to water quality data to help decision makers and stakeholders better understand the status of California's waters and aquatic ecosystems, as well as public health and welfare issues related to water quality.

In an attempt to improve data consistency and transparency, the CWQMC created workgroups addressing questions such as, "Is our water safe to drink?" Customized web portals were created with relevant data to answer each water quality question. The workgroups also coordinated monitoring efforts and identified improved data management procedures related to each question. Nine workgroups have formed; Ms. Larsen focused her talk on the Estuaries Monitoring Workgroup. This workgroup's monitoring and reporting is coordinated by the IEP, with additional funding from the State and Federal Contractors Water Agency. The portal is meant to be educational and provides a snapshot of current estuary health, including biological resources and water quality. The portal dashboard features background information on each available dataset (e.g., benthic organisms), information on who is doing the monitoring, where and when the monitoring occurs, and links to relevant technical reports.

While the web portals and workgroups have been successful in improving working relationships among agencies, the portals need on-going updating to improve effectiveness. Ms. Larsen discussed other CWQMC challenges, including the need for dedicated funding, personnel turnover, and the lack of a communication strategy. She also outlined the CWQMC's future priorities: development of recommendations for effective data sharing among agencies, data providers, and users; identification of agency monitoring priorities for existing workgroups; and the development of new workgroups focused on the Delta, cyanobacteria and harmful algal blooms, and the human right to water.

Announcement of New Additions to the Delta Science Program's Science Advisory Committee

The Science Advisory Committee (SAC) was established to advise the Delta Science Program on Delta Science Plan implementation and associated efforts to develop a shared scientific understanding of the Delta. Three members recently were added to the SAC:

- **Dr. Newsha Ajami** is a senior research associate at the Stanford Woods Institute for the Environment, where she serves as the Director of Urban Water Policy for the Water in the West initiative. She is a hydrologist who specializes in sustainable water resource management and flood and water supply forecasting. Dr. Ajami's work is interdisciplinary and focuses on improving the science-policy-stakeholder interface by incorporating social and economic measures, as well as relevant and effective communication.
- **Dr. Mark Lubell** is a professor in the Department of Environmental Science and Policy and the Director for the Center for Environmental Policy and Behavior at UC Davis. Dr. Lubell studies cooperation problems and decision-making in environmental, agricultural, and public policy. His current projects investigate

watershed management, environmental activism, agricultural best practices, and institutional changes in local governments.

- **Dr. Tamara Kraus** is a research soil scientist with the U.S. Geological Survey's California Water Science Center. She studies the cycling of carbon and nutrients, and linkages between terrestrial and aquatic ecosystems. Dr. Kraus' projects address a range of topics including identifying sources of dissolved organic carbon to inform drinking water quality management, the use of constructed wetlands to reverse subsidence, and the removal of mercury from surface waters.

Upcoming Salmon Disease Ecology Workshop

On March 14, 2018, the Delta Science Program, in collaboration with the UC Davis Coastal and Marine Sciences Institute, will host a one-day workshop on disease in Pacific salmon. Along the west coast of the United States, pathogens and diseases have been linked to salmon mortality and population declines. Many unanswered questions, however, remain regarding the linkages between environmental conditions and the effects that pathogens and disease have on salmon populations. The workshop will be structured around four research and management themes: 1) exploring the current state of knowledge about salmon pathogens and disease in California; 2) learning about available tools that are being developed to better study disease and disease impacts; 3) examining case studies from other river systems that have integrated monitoring and research to manage disease effects on salmon; and 4) identifying key information and knowledge gaps necessary to guide research and management of pathogens and disease in wild salmon populations. The workshop will take place at the UC Davis Activities and Recreation Center (ARC) in Ballroom A.

To register for the event and/or view the save the date flyer and draft agenda, please visit: <http://www.deltacouncil.ca.gov/event-detail/15316>.

By the Numbers

Delta Science Program staff will give a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

List of Attachments

Attachment 1: By the Numbers Summary (report to be provided at the Council Meeting)

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